APPTRONICS review

Volume 1, Issue 1. 2008 August 30.

Message from Director

I am happy to note that the Department of Applied electronics and instrumentation has acted fast on the recommendation to start the publication of a research bulletin and that the first issue is being released on August 30 at the pleasant occasion of the inauguration of its branch association, APPTRONICS.

Let this effort continue successfully and let it be an encouragement to all my staff and students to take up publications seriously. I see it as a model for other departments.

Wish you all success.
May God bless you.

Fr. Jose Alex Oruthayapally CMI
Director, RASET.

Message from Principal

I am very happy to note that the AEI department is bringing out the first issue of its departmental bulletin on the occasion of the inauguration of APPTRONICS 2008.

I am sure that this bulletin will be an inspiration to the students and staff of RASET to improve their technical knowledge and also to produce useful papers.

Dr. J. Isaac,
Principal, RASET.

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FOREWORD

We are happy that, based on the recommendation of the expert committee, we have made a humble start to publish a regular research bulletin from the Department of Applied Electronics and Instrumentation. This is the first issue. We hope to have such issues released regularly. The periodicity proposed now is a month.

We do not claim that it is all that brilliant. But we do claim that it is an earnest attempt to produce something new. We hope to foster research curiosity of our young faculty and youth. We expect that it will generate enthusiasm among our students and faculty to search for ideas, take up research challenges, and seed a new culture.

It is just a start. There is a long way to go, a very long way to go.

HOD,
Department of Applied Electronics and Instrumentation.

Contents

PROJECT FOR SALE

Use tungsten oxide thin film to make ammonia sensor

Ammonia is a toxic gas. Long term exposure to even 25 ppm of ammonia is hazardous to living beings. It would be wise if we could detect the amount of ammonia present around us, especially where we expect it to be polluted.

Let me suggest a new, to the best of my knowledge, idea for developing a low cost ammonia detector using tungsten oxide thin film sensors. Of course there are many types of ammonia sensors available in market. But it is expected that tungsten oxide thin film sensor can provide better sensitivity, linearity and cost effectiveness.

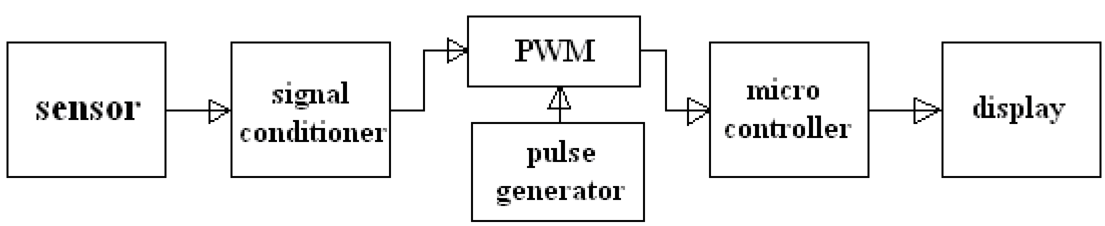
Sensor

Tungsten oxide thin film sensors can be manufactured in two different ways

1) RF Sputtering method
2) Reactive evaporation using tungsten filament.

Sensor produced by thermal evaporation method has a lower operating temperature and it shows much linear sensitivity. So it is preferable to thermally evaporated tungsten thin film sensor.

Instrumentation



Working

When the sensor is exposed to air, its conductance changes according to the amount of ammonia present in the atmosphere. Sensitivity to ammonia, as compared to other gases, is achieved through control of temperature. Conductance change is converted in to voltage signal by using dc bridge circuit. This voltage signal is conditioned by signal conditioning circuit and is given to a pulse width modulator where it is modulated with a square wave. The modulated pulse is then given to a microcontroller for estimating the time duration of the pulse. Calibration is done in such a way that the pulse width is proportional to the amount of ammonia present in atmosphere.

--- ***Sreejith KR***

MPEG Standards Demystified...

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Most of us might have listened to mp3 songs from CD player, iPod, laptop and cell phone, and watched movies from VCDs, DVDs and internet without knowing the underlying technology had the same experience. This article is an attempt to share my understanding on the MPEG (Motion Picture Experts Group) standards, and the applications.

MPEG was set up by ISO/IES standardization body in 1988 to develop generic standards for representation of video or motion pictures, associated audio and their combination. The goal was to reduce bit rate for storage, transmission, and multimedia applications. Perceptual quality is taken into consideration in these standards.

First of such standards was MPEG1 that emerged in 1992. Audio part of MPEG1 consists of 3 modes of operation called layers. Complexity and performance increase from layer 1 to layer 3. Layer 3 provides highest quality even at bitrates as low as 128 kbps (kilo bits per second) for stereo signal. MPEG1 layer 3 is popularly known as MP3. MP3 reduces audio data size by eliminating high and low frequencies in the data that are undetectable by human ear. MPEG1 video supported only frame videos (not interlaced) with restriction on frame size and hence is not suitable for digital television. At the highest quality, MPEG1 video is compressed to 1.5Mbps (Mega bits per second). VCDs make use of this technology.

MPEG2 denotes the second phase and was finalized in 1994. It could handle interlaced video and hence is suitable for digital television. The audio standard allowed coding of lower sampling frequencies, 16kHz, 22.05kHz and 24kHz. No new coding algorithm was introduced in this standard; the emphasis was on backward compatibility.

MPEG2 AAC (Advanced Audio Coding) introduced after 1994, is not backward compatible, but introduced new coding algorithms in order to achieve better quality and greater compression. The compressed video rate is between 3.5Mbps and 6 Mbps. DVDs as well as satellite and cable industries make use of this standard.

MPEG3 was started to cater to HDTV (High Definition Television) applications; but since the developments in MPEG2 made it0 adequate for HDTV, MPEG3 was rolled into MPEG2.

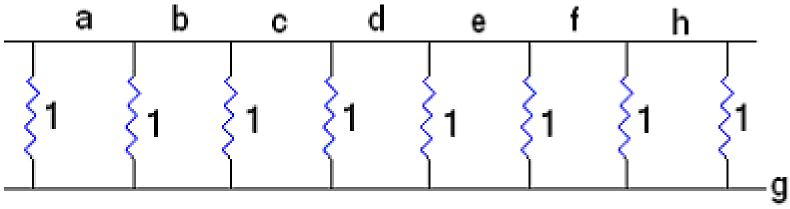
MPEG4 was finalized in 1998, and it emphasized on new functionalities like error robustness, rather than improving compression efficiency. MPEG4 compressed video rate ranges from 5kbps to 10Mbps. The audio part consists of a family of audio coding algorithms which cater to applications involving speech coding at low bit rate (2 kbps) to high quality audio coding (64kbps per channel). Mobiles and internet streaming make use of this technology.

MPEG7, formally known as multimedia content description interface, was approved in 2001. It does not deal with compression algorithms. It deals with representation of content in a format suitable for multimedia information search, filtering, management and processing.

MPEG standards became popular because these are open standards. No company owns the standard, and source code is made available to avoid any misinterpretation of the standard by implementers. However, the source code can not be directly used in real time applications. While compression standards are technology enablers, VLSI and software implementations make the technology available to end users.

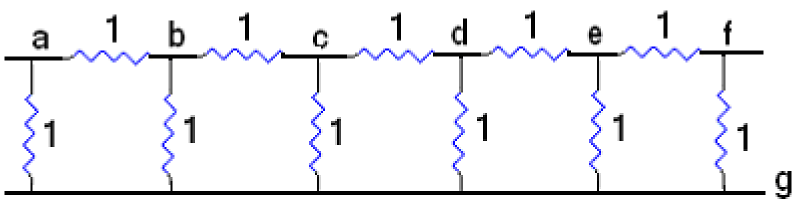
RECTANGULAR RESISTANCE SERIES!

Take a one ohm resistor. Connect one ohm resistors parallel to it as shown one after another each time noting the effective resistance (Across ag, bg, cg, dg, etc.). The effective resistance values form a series: 1/1, 1/2, 1/3, 1/4, etc.



The denominators of the terms are counting numbers in order. Do you see any other speciality?

What about the following case? Here we connect two one-ohm resistors in series as shunt to one, each time noting the effective resistance across ag, bg, cg, dg, eg, etc. The effective resistance values form a series: 1/1, 2/3, 5/8, 13/21, 34/55, etc. Do you see anything special about this series? Anything familiar?



Greatest European mathematician of the middle ages, Leonardo of Pisa, known as Fibonacci (pronounced fib-on-arch-ee).

Don't try to experimentally confirm! If you want to, you may have to go for rounding up of many numbers. Do not forget about tolerances and measurement errors. ***--- PRM.***

Tension created by Surface Tension

Students' Page ✓

We realise that it is not that simple as we thought it to be. It is not simple nor easy to be innovative.
Sure, we have made an earnest attempt to do something new, something useful. I am presenting to you a brief on what we attempted to do in terms of our mini project, which turned out to be a major one.

We started off with an idea to make a simple instrument, which can measure and display the surface tension of a given liquid. The idea was all simple. But realisation was not so. There were hurdles at every stage. Hurdles related to availability of components, hurdles related to never expected misbehavior of our sensing element.

Idea!
That was simple.
Measure the pull force exerted by the surface of liquid as soon a the sensing element touches it.

Problem-
Surface tension is very small: make it measurable. So have a mechanical multiplier.
Surface tension is per length.
So have long length for the sensor.
We made a flat mesh of wires in a rigid and tight frame.

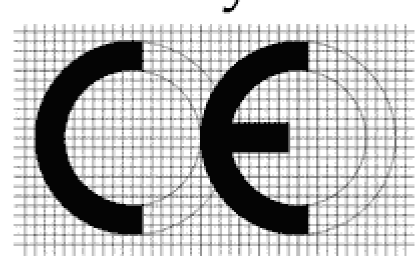
Problem-
Make the whole mesh touch the surface of water. Use the pull on the mesh to deflect a simply supported cantilever.
Deflection of cantilever end must form a measure of surface tension.
How to measure the deflection? That was the next issue. Bond strain gauge at the root of the cantilever. Measure the strain. Calibrate in terms of force. Looked very simple. But where to get strain gauge, where to get reliable and long lasting bonding material? How to learn the bonding procedure? Where do we get time for all these?

We went for another solution. Have a fixed parallel plate near the deflecting end of the cantilever. *-Use silk if linen is not available-*. Measure the capacitance. We made an oscillator using the capacitance. Good, it worked.
We started trial runs. Alas! We found it difficult to make the sensing element touch the surface of liquid evenly. Whatever care we take there is always a first point, or a first line, to touch. From there it pulls off.

Yes we are still on the job. We will solve it. *Where there is a will there is a way.*

-Anu George & Mark Mathews, **S7AEI**

Curiosity corner



Hand over 5 lines on this to HOD, AEI